

**TAXONOMIC AND BIOLOGICAL NOTES ON  
NORTH AMERICAN SPECIES OF *ELATOPHILUS* REUTER  
(HEMIPTERA: HETEROPTERA: ANTHOCORIDAE)**

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*Abstract.*—There are 18 species in the wide-ranging genus *Elatophilus* Reuter. Five species are known predators of species of the scale genus *Matsucoccus* Cockerell. Several species of *Elatophilus* occur outside the range of *Matsucoccus*, suggesting other prey besides *Matsucoccus* may be involved, perhaps aphids.

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The anthocorid genus *Elatophilus* Reuter is Holarctic and contains 18 species, eight of which are found in North America. These predaceous anthocorids occur only on coniferous trees and chiefly on species of *Pinus* L., although they have been recorded from other genera such as *Abies* Mill. and *Picea* Dietr. (Kelton, 1976).

Several species of *Elatophilus* have been associated with the magarodid scale genus *Matsucoccus* Cockerell. Some species of this genus are pests of pine in both the Old and New World [e.g., *M. feytaudi* Ducassee in Europe (Biliotti and Riom, 1967) and *M. resinosae* Bean and Godwin in eastern United States (Drooz, 1985)]. For some of these scales, species of *Elatophilus* have been documented as their predators [e.g., *E. nigricornis* (Zetterstedt) (Pericart, 1972) and *E. inimicus* (Drake and Harris) (Lusier, 1965)].

We had completed a manuscript (Lattin and Stanton, 1992) on the Anthocoridae associated with *Pinus contorta* Dougl. ex Loud., including a review of several species of *Elatophilus*, when the paper by Mendel et al. (1991) appeared. They presented an interesting summary of information on this genus, documented five species as specialized predators of *Matsucoccus* spp. and proposed a coevolutionary relationship with pine bast scales. One of these, *E. inimicus*, occurs in North America where it is a predator of the red pine scale, *M. resinosae* Bean and Godwin. In examining the information Mendel et al. presented for the eight North American species of *Elatophilus*, we found that some corrections were needed to evaluate their hypothesized *Elatophilus*-*Matsucoccus*-*Pinus* linkage. These are detailed in the text that follows.

**TAXONOMIC AND BIOLOGICAL INFORMATION**

*Elatophilus antennatus* Kelton

This species was described from four females collected at San Cristobal, Chiapas, Mexico (Kelton, 1976). No other records of this species have been reported in the literature. Because of its location, it was not included by Henry (1988) in the catalog

of North American Heteroptera. Mendel et al. (1991), citing only Kelton (1976), reported it from Mexico and Arizona, apparently the latter location in error. As these authors indicated, the species was collected by Kelton on *Pinus oocarpa* Schiede which occurs only in Mexico (Critchfield and Little, 1966). This species belongs to the subsection *Oocarpae* Little and Critchfield, a section that includes such species as *P. radiata* D. Don, *P. attenuata* Lemm., *P. muricata* D. Don, *P. patula* Schiede and Deppe, *P. greggii* Engelm. and *P. pringlei* Shaw (Critchfield and Little, 1966).

*Elatophilus brimleyi* Kelton

Kelton (1977) described this species from a single female collected in Prince Edward County, Ontario, Canada, but provided no biological or ecological information. Kelton included the species in his 1978 publication but added no new information. Henry (1988) cited the Ontario record in the catalog and placed the species in the nominate subgenus. Mendel et al. (1991) suggested that *Pinus strobus* L. might be the host tree and the prey species, *Matsucoccus macrocitrices* Richards. There are four native species of *Pinus* that occur at or close to the type locality in Ontario besides the introduced species, *P. sylvestris* L. (Little, 1979). Each of these pines might have species on *Matsucoccus* that are potential prey.

*Elatophilus dimidiatus* (Van Duzee)

This species was described by Van Duzee (1921) (in *Anthocoris*) from three females collected in northern California; no host data were included. Drake and Harris (1926) included one specimen from the type series in describing the new species *Temnostethus fastigiatus*, based on additional specimens from California. Kelton (1976) placed *A. dimidiatus* in the genus *Elatophilus* and mentioned the habitat was unknown. Henry (1988) reported California as the only locale and placed the species in the nominate subgenus. Although Mendel et al. (1991), citing Kelton (1976), listed an unknown species of *Pinus* as a possible host and *Matsucoccus* spp. as the prey, a question mark should be placed in front of *Matsucoccus* in their table because no prey information is yet available for this anthocorid.

We have collected *E. dimidiatus* at several localities in California on *Pinus contorta murrayana* (Grev. and Balf.) Engelm. and in Oregon on *P. ponderosa* Dougl. ex Laws. (Lattin and Stanton, 1992), but we have not confirmed any prey species. Furniss and Carolin (1977) cited only *Matsucoccus bisetosus* Morrison on *Pinus contorta* but other Homoptera occur on this host, including the pine needle scale, *Chinoaspis pinifoliae* (Fitch) (Diaspididae), and species of the aphid genera *Cinara* Börner and *Essigella* del Guercio, and species of *Pineus* Shimer (Phylloxeridae). These two authors also listed *M. bisetosus* and *M. fasciculensis* Herbert from *Pinus ponderosa* in Oregon.

*Elatophilus inimicus* (Drake and Harris)

Drake and Harris (1926) described this species, without host or prey information, from a female collected at Taghanic, Ithaca, New York (as a species of *Xenotracheiella* Drake and Harris). Kelton and Anderson (1962) placed *Xenotracheiella* into synonymy with *Elatophilus*. Kelton (1976) synonymized *X. vicaria* Drake and Harris

(1926) with *E. inimicus* (Drake and Harris) [not *E. vicarius* Kelton and Anderson as stated by Mendel et al. (1991) and parentheses should be placed around *E. inimicus* (Drake and Harris) because the species was described in *Xenotrachelella*]. No host or prey information was given for *X. vicaria*, described from Marquette, Michigan, by Drake and Harris (1926).

Kelton (1976) added records from Manitoba, Ontario, Quebec, Connecticut, and North Carolina (in addition to previous Michigan and New York records), stated that *Pinus banksiana* Lamb. was the host plant, but suggested other species of conifers as possible hosts. His only prey information was "It preys on the small arthropods living in the bark." Kelton (1978) added no new information. Henry (1988) placed *E. inimicus* in the nominate subgenus *Elatophilus* Reuter.

Doane (1965) reported *E. inimicus* on *Pinus resinosa* Ait., and Lussier (1965) added *P. rigida* Mill. and *P. sylvestris*. Apparently, *E. inimicus* has been found on *P. resinosa* only outside the natural range of the tree where it is found in plantations. These are the sites where populations of the red pine scale, *M. resinosa*, were first discovered and associated with *E. inimicus*. Drooz (1985) reported this bug "... on pines" without specific host names but said it occurred with several species of *Matsucoccus*. Mendel et al. (1991) listed *P. banksiana*, *P. resinosa* and *P. rigida* as host plants.

Doane (1965) cited *E. inimicus* (as *X. inimica*) as a predator of *M. resinosa* in Connecticut. Lussier (1965) detailed its role as a predator of *M. resinosa*. He also stated that the bug occurs with *M. gallicolus* Morrison on *Pinus rigida* in Massachusetts (no actual feeding was reported) in association with aphids and mites, and in Connecticut on *P. sylvestris* in the absence of *Matsucoccus*. Mendel et al. (1991) reported *M. gallicolus* (on *P. banksiana* and *P. rigida*) and *M. matsumurae* Kuwana (on *P. resinosa*) as the prey, but because no actual feeding was observed on *M. gallicolus*, a question mark should be placed before the name in their table. Since *Pinus banksiana* is one of the host plants (Kelton, 1978), one might add *Matsucoccus banksianae* Ray and Williams, with a question mark in front, to the list of possible prey since the scale occurs close to the bug's known range of the anthocorid bug (Ray and Williams, 1991). Drooz (1985) stated that *M. gallicolus*, the pine twig gall scale, is found on *Pinus echinata* Mill., *P. glabra* Walt., *P. ponderosa*, *P. pungens* Lamb., *P. resinosa*, *P. rigida*, *P. taeda* L., and *P. virginiana* Mill. He did not indicate whether the scale occurred on jack pine (*P. banksiana*) (but see Ray and Williams, 1991).

Mendel et al. (1991) listed *M. matsumurae* on *P. resinosa* as the prey of *E. inimicus* in North America, but there is question as to whether this scale actually occurs in the Nearctic Region. All prior references, except that of Morrison (1939), have cited *M. resinosa* Bean and Godwin as the species on red pine (Doane, 1959, 1965; Lussier, 1965; Ray and Williams, 1984; Drooz, 1985). Kosztarab and Kozar (1988) gave the distribution of *M. matsumurae* as Trans-Palaearctic, extending from England to Japan and found on various Old World pines. Morrison (1939) stated that he had reported *M. matsumurae* from Alabama (1928) but he used these specimens in describing the new species of *M. alabamiae* Morrison (1939). Miller and McClure (1984) discussed problems in identifying *M. resinosa* using female sex pheromones. Additional work on this problem is underway (D. R. Miller, pers. comm., 19 November 1991). M. L. Williams (pers. comm., 18 November 1991) also indicated there is still no positive identification of *M. matsumurae* from North America and that *M. resinosa* is def-

initely a synonym of *M. matsumurae*. Because there apparently is no definite record of *M. matsumurae* from the United States, the citation by Mendel et al. (1991) should be changed to *M. resinosa*. There are no references to this usage in the three references they cite (i.e., Lussier, 1965; Kelton, 1976, 1978). However, we do note that Mendel et al. (1991) reported *M. matsumurae* as prey of *Elatophilus nipponensis* Hiura on *Pinus densiflora* Sieb. and Zucc. and *P. thunbergiana* Franco in South East Asia.

#### *Elatophilus minutus* Kelton

Kelton (1976) described this species from Laniel, Quebec, and included specimens from Alberta, Manitoba, Ontario, and Saskatchewan in the type series; specimens collected on young jack pine (*Pinus banksiana*) were noted without localities. *Pinus banksiana* ranges throughout the region of the general collection localities (Critchfield and Little, 1966). Kelton (1978) repeated this information, added that specimens were active on the trees, but gave no specific prey information. Henry (1988) placed *E. minutus* in the nominate subgenus.

Mendel et al. (1991) repeated most of the above information, omitting Alberta and Saskatchewan from the distribution, and reported *Matsucoccus banksianae* as prey. A question mark should be placed before the prey citation since actual feeding has not been observed. *Matsucoccus banksianae* is known only from Cass County, and Ely, Minnesota, where it was collected on *Pinus banksiana*. This is close to the reported range of *E. minutus*, but as yet the anthocorid and scale have not been collected together.

#### *Elatophilus oculatus* (Drake and Harris)

Drake and Harris (1926) described this species (as *Xenotracheliella oculata*) from a male collected at Williams, Arizona, with no biological information. Kelton and Anderson (1962) placed *X. oculata* in *Elatophilus*. Kelton (1976) included *E. oculatus* in his generic review, stating he saw only the type specimen, although he added that the species was collected on *Pinus ponderosa*, he did not give the origin of that information. *Pinus ponderosa scopulorum* Engelm. is found near Williams, but so are at least three other species of *Pinus* including *P. monophylla* (Torr. and Frem.) Although Mendel et al. (1991) repeated Kelton's (1976) information, a question mark should be placed before the host because no positive record exists. Henry (1988) placed *E. oculatus* in the nominate subgenus.

#### *Elatophilus pinophilus* Blatchley

Blatchley (1928) described this species from a single female collected at Royal Palm Park (now Everglades National Park), Florida, noting it had been collected from "... the top of a dead and fallen pine." Kelton (1976) was unable to locate Blatchley's type when he reviewed the genus *Elatophilus*. Henry (1988) listed Florida as the only known locale. Blatchley (1928) placed *E. pinophilus* in the subgenus *Euhadrocerus* Reuter and at present is the only North American species included in that taxon even though several other North American species have enlarged antennae (Henry, 1988). Four European species belong to this subgenus (Pericart, 1972).

Mendel et al. (1991) listed *Matsucoccus alabama* (sic) Morrison (*M. alabamiae* is correct) and *M. gallicolus* as possible prey. *Matsucoccus alabamiae* is known only

from Alabama, on *Pinus* sp. (Morrison, 1939). Ray and Williams (1984) indicated that *M. alabamiae* feeds on pines of the subsection *Australes* without citing species. Little (1979) listed seven species of *Pinus* from Florida; of these, six belonged to the subsection *Australes* and only *P. clausa* (Chapm.) Vasey belongs to the subsection *Contortae*. *Matsucoccus gallicolus* is widespread in eastern and southeastern United States and has been recorded from five species on *Pinus* (Morrison, 1939). Ray and Williams (1984) mentioned only that this scale feeds on a variety of pines.

*Elatophilus pullus* Kelton and Anderson

This species was described from southeastern British Columbia and central Oregon from specimens collected on *Pinus ponderosa* (Kelton and Anderson, 1962). Anderson (1962) provided biological information on *E. pullus*, including nymphal development in the laboratory and the field, and noted that overwintering occurs as fifth instar nymph in British Columbia. He gave the phenology of the adults in spring, stating males die within a month of appearance. This may explain the preponderance of females collected and why Pericart (1967) also notes the rarity of *Elatophilus* males. Kelton (1976) added no new information but (1978) reported it from Alberta and added *Pinus contorta*, *P. flexilis* James, and *Picea glauca* (Moench) Voss as hosts. Evans (1983) reported it from yellow pine (*P. ponderosa*) in southern British Columbia. Henry (1988) placed *E. pullus* in the nominate subgenus.

Mendel et al. (1991) doubted the validity of Anderson's (1962) record of rearing *E. pullus* nymphs on the filbert aphid *Myzocallis coryli* Goeze, stating that development instead might have resulted from cannibalism. They also challenged Sands' (1957) statement that *E. nigricornis* (Zetterstedt) feeds on conifer aphids in the United Kingdom. Cobben and Arnoud (1969) stated that additional work was needed to clarify the discrepancy between feeding habits of *E. nigricornis* in the northern and southern portions of its range. Woodroffe (1969) mentioned morphological differences between the populations of this species in Scotland and those from southern England, noting the latter may be derived from the European Continent. There is the possibility that other prey are involved.

Mendel et al. (1991) listed *Matsucoccus bisetosus* Morrison as possible prey of *Elatophilus pullus* on *Pinus ponderosa* and *P. contorta*, and *M. acalyptus* Herbert as possible prey on *Pinus flexilis*. According to Furniss and Carolin (1977), *M. bisetosus* occurs on *P. ponderosa*, *P. jeffreyi* Grev. and Balf., *P. contorta*, *P. sabiniana* Dougl. and *P. radiata* D. Don, whereas *M. acalyptus* is found chiefly on the pinyon pines *P. edulis* Engelm. and *P. monophylla* Torr. and Frem., *Pinus balfouriana* Grev. and Balf., *P. aristata* Engelm. and *P. lambertiana* Dougl.; *M. paucicatricis* Morrison is found on *P. flexilis*. Most of these pines occur south of the known range of *E. pullus*. Unruh and Luck (1987) studied *M. acalyptus* on *P. monophylla* but did not mention *Elatophilus*.

DISCUSSION AND CONCLUSIONS

The anthocorid genus *Elatophilus* is a wide-ranging taxon with 18 known species. Some have been recorded as predators of the margarodid scale genus *Matsucoccus*. Both bug and scale are found chiefly on pines (Mendel et al., 1991). They suggested that species of *Elatophilus* prey only on species of *Matsucoccus*. While this is possible, only five of the eighteen species of *Elatophilus* have been verified as *Matsucoccus*

predators. Moreover, there is evidence that prey other than *Matsucoccus* may be involved (Anderson, 1962; Cobben and Arnoud, 1969; Sands, 1957).

The map presented by Mendel et al. (1991) shows that a very substantial portion of the range of *Elatophilus* in Europe and of northern Asia lies outside of the range of *Matsucoccus*. The entomofauna of Europe is especially well known, including the Anthocoridae (Pericart, 1972) and the Margarodidae (Kosztarab and Kozar, 1988). The absence of *Matsucoccus* in Norway, Sweden and Finland, for example, suggests that the *Elatophilus* occurring there have prey species other than *Matsucoccus*. However, their prediction that *Matsucoccus* occurs on Cyprus was substantiated by the 1991 collections of *M. josefi* Bodenheimer and Harpaz and *M. pini* Green (Mendel et al., 1991:505). Mendel et al. (1991) have presented an interesting hypothesis but considerably more evidence is required before it can be concluded that all species of *Elatophilus* feed only on species of *Matsucoccus*. Perhaps species of *Matsucoccus* will be collected in northern Europe after all.

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#### LITERATURE CITED

- Anderson, N. H. 1962. Anthocoridae of the Pacific Northwest with notes on distributions, life histories, and habits (Heteroptera). *Can. Entomol.* 94:1325-1334.
- Biliotti, E. and J. Riom. 1967. Faune corticole du pin maritime: *Elatophilus nigricornis* [Hem. Anthocoridae]. *Ann. Soc. Entomol. France (N.S.)* 3:1103-1108.
- Blatchley, W. S. 1928. Two new anthocorids and a new microphysid from Florida (Heteroptera). *Entomol. News* 39:85-88.
- Cobben, R. H. and B. Arnoud. 1969. Anthocoridae van *Viscum*, *Buxus* en *Pinus* in Nederland (Heteroptera). *Publicaties van het Natuurhistorisch Genootschap in Limburg* 19:5-16.
- Critchfield, W. B. and E. L. Little, Jr. 1966. Geographic distribution of the pines of the world. U.S. Department of Agriculture, Forest Service. Misc. Pub. No. 991, 97 pp.
- Doane, C. C. 1959. The red pine scale. Connecticut Agric. Expt. Stat. Circ. 207, 7 pp.
- Doane, C. C. 1965. The red pine scale. Connecticut Agric. Expt. Stat. Circ. 207 (revised), 7 pp.
- Drake, C. J. and H. M. Harris. 1926. Notes on American Anthocoridae with descriptions of new species. *Proc. Biol. Soc. Wash.* 39:33-46.
- Drooz, A. T. (ed.). 1985. Insects of eastern forests. U.S. Department of Agriculture, Forest Service. Misc. Pub. No. 1426, 608 pp.
- Evans, D., 1983. Annotated checklist of insects associated with native pines in British Columbia. Environment Canada, Pacific Forest Research Centre, Canadian Forest Service, Information Report BC-V-244, 50 pp.
- Furniss, R. L. and V. M. Carolin. 1977. Western forest insects. U.S. Department of Agriculture, Forest Service. Misc. Pub. No. 1339, 654 pp.
- Henry, T. J. 1988. Family Anthocoridae. Pages 12-28 in: T. J. Henry and R. C. Froeschner (eds.), *Catalog of the Heteroptera, or True Bugs, of Canada and the Continental United States*. E. J. Brill, Leiden, 958 pp.

- Kelton, L. A. 1976. The genus *Elatophilus* Reuter in North America with descriptions of two new species (Heteroptera: Anthocoridae). *Can. Entomol.* 108:631-634.
- Kelton, L. A. 1977. A new species of *Elatophilus* Reuter from Ontario, and new synonymy for *Piezostethus flaccidus* Van Duzee (Heteroptera: Anthocoridae). *Can. Entomol.* 109: 1017-1081.
- Kelton, L. A. 1978. The insects and arachnids of Canada. Part 4. The Anthocoridae of Canada and Alaska. Heteroptera: Anthocoridae. Canada Department of Agriculture, Research Branch, Pub. 1639, 101 pp.
- Kelton, L. A. and N. H. Anderson. 1962. New Anthocoridae from North America, with notes on the status of some genera and species (Heteroptera). *Can. Entomol.* 94:1302-1309.
- Kosztarab, M. and F. Kozar. 1988. Scale Insects of Central Europe. Junk Publ., Dordrecht, 456 pp.
- Lattin, J. D. and N. L. Stanton. 1992. A review of the species of Anthocoridae (Hemiptera: Heteroptera) found on *Pinus contorta*. *J. N. Y. Entomol. Soc.* 100:424-479.
- Little, E. L., Jr. 1979. Checklist of United States trees (native and naturalized). U.S. Department of Agriculture, Forest Service, Agriculture Handbook No. 541, 375 pp.
- Lussier, S. J. 1965. A study of *Elatophilus inimicus* D. & H. (Hemiptera: Anthocoridae) and its role in the natural control of the red pine scale *Matsucoccus resinosa* B. and G. (Homoptera: Margarodidae). Master's thesis, University of Massachusetts.
- Mendel, Z., E. Carmi and H. Podoler. 1991. Relation between the genera *Matsucoccus* (Homoptera: Margarodidae) and *Elatophilus* (Hemiptera: Anthocoridae) and their significance. *Ann. Entomol. Soc. Amer.* 84:502-507.
- Miller, D. R. and M. S. McClure. 1984. Attractivity of the female sex pheromone of Chinese *Matsucoccus matsumurae* (Kuwana) to males of *M. matsumurae* in Japan and to males of *M. resinosa* Bean and Godwin in the United States (Margarodidae, Coccidoidea, Homoptera). *Contr. Shanghai Inst. Entomol.* 4:1-20.
- Morrison, H. 1928. A classification of the higher groups and genera of the coccid family Margarodidae. U.S. Department of Agriculture, Tech. Bull. 52, 239 pp.
- Morrison, H. 1939. Descriptions of new species of *Matsucoccus* (Hemiptera: Coccidae). *Proc. Entomol. Soc. Wash.* 41:1-20.
- Pericart, J. 1967. Note taxonomique au sujet du genre *Elatophilus* Reuter. Description d'une espece nouvelle et observations diverses (Het. Anthocoridae). *Bull. Soc. entomol. France.* 72:52-60.
- Pericart, J. 1972. Hemipteres Anthocoridae, Cimicidae et Microphysidae de l'ouest-Palaerctique. Masson et Cie, Paris, 402 pp.
- Ray, C. H., Jr. and M. L. Williams. 1984. Two new species of *Matsucoccus* (Homoptera: Margarodidae) from Arizona and Mexico with a key to species in North America. *Ann. Entomol. Soc. Amer.* 77:765-769.
- Ray, C. H., Jr. and M. L. Williams. 1991. Two new species of *Matsucoccus* Cockerell (Homoptera: Margarodidae) similar to *Matsucoccus alabamiae* Morrison. *Proc. Entomol. Soc. Wash.* 93:186-192.
- Sands, W. A. 1957. The immature stages of some British Anthocoridae. *Trans. Royal Entomol. Soc. London.* 109:295-310.
- Unruh, T. R. and R. F. Luck. 1987. Deme formation in scale insects: a test with the pinyon needle scale and a review of other evidence. *Ecol. Entomol.* 12:439-449.
- Van Duzee, E. P. 1921. Characters of eight new species of North American Anthocoridae or flower bugs. *Proc. Calif. Acad. Sci., 4th Series,* 11:137-144.
- Woodroffe, G. E. 1969. Notes on some Hemiptera-Heteroptera from Aviemore, Inverness-shire. *Entomol. Mon. Mag.* 105:165-166.